VARIABLY CONFIGURABLE TRACK-TYPE MOBILE SHELVING SYSTEM

BACKGROUND AND SUMMARY OF THE INVENTION

This invention relates to a storage system, and more particularly to a high density storage system that can be assembled on-site in different configurations.

High density storage systems are well known, and typically include a series of storage units such as shelves, file cabinets or the like that are movable so as to eliminate the presence of an isle between adjacent storage units, thereby reducing the amount of space occupied by the storage system. In a lateral configuration, the storage units are movably mounted to a pair of spaced apart rails, so that storage units can be moved laterally toward and away from each other so as to selectively create an isle between adjacent storage units when it is desired to gain access to the items supported by the storage units. In a pull-out configuration, the storage units are positioned side-by-side, and each storage unit is mounted to a pair of rails for movement between an extended position and a retracted position. When it is desired to gain access to the contents of one of the storage units, the storage unit is moved to its extended position while the adjacent storage units remain in the retracted position, to expose the contents of the extended storage unit.

Typically, high density lateral storage systems involve the use of a wheeled carriage or base, which includes a frame and other structural components to which the storage unit is mounted. The carriage or base is then engaged with floor-mounted rails, which typically are embedded in or otherwise permanently mounted to a floor. In a pull-out system, the base may include wheels which directly engage the floor so as to provide movement of the storage unit. Alternatively, the base may include a slide-type arrangement for providing cantilevered support of the storage unit when in the extended position.

Various types of high density lateral and pull-out storage systems, as described above, are available from Spacesaver Corporation of Fort Atkinson, Wisconsin. Representative applications of storage systems of this type include office, institutional and educational environments, wherein large quantities of dense objects such as papers, files, books, etc. are contained on the storage units. Such storage systems have a relatively heavy duty construction, and are installed and maintained by skilled, trained workers.

It is an object of the present invention to provide a high density storage system which is well suited for light duty use, e.g., in a residential application, to contain items typically stored in a basement, garage or the like. It is a further object of the invention to provide such a storage system which can be produced, shipped and sold in knock-down form, and which can then be assembled on site using a minimal number of tools. It is a further object of the invention to provide such a storage system which is relatively simple in its components and construction, to provide ease of assembly and installation. Yet another object of the invention is to provide such a storage system in which the storage units can either be configured to move laterally toward and away from each other, or in which the storage units can be moved axially between extended and retracted positions.

In accordance with one aspect of the invention, a storage system includes a storage unit, a wheel arrangement and a guide arrangement including at least one rail. The storage unit, the wheel arrangement and the guide arrangement are constructed from components that are configured to be transported together in a disassembled state to an installation site that includes a support surface, and to be assembled at the installation site. Assembly of the system involves engaging the wheel arrangement with the storage unit and securing the rail of the guide arrangement to the support surface. When the storage unit is assembled, the wheel engagement is engageable with the rail to provide movement of the storage unit relative to the support surface. The wheel arrangement can be secured to the storage unit in either a first orientation so as to provide movement of the storage unit in a first direction, or in a second orientation so as to provide movement of the storage unit in a second direction transverse to the first direction. The rail is adapted to be engaged with the support surface so as to guide movement of the storage unit in either the first direction or the second direction.

In accordance with another aspect of the present invention, a mobile storage system includes a series of storage units, a guide arrangement configured for engagement with a support surface and including at least one guide rail, and a series of wheeled members that are interposed between each storage unit and the guide arrangement. Each storage unit and its associated wheeled members include a cooperative positioning arrangement to

position the wheeled members in either a first orientation or a second orientation, according to the desired direction of movement of the storage unit. The guide rails are engaged with the support surface in a desired orientation that provides movement of the storage units on the guide rail in either a first direction or in a second direction, according to the orientation of the wheeled members.

In accordance with another aspect of the present invention, a method of constructing a mobile storage system includes the acts of providing one or more storage units as well as a guide arrangement including at least one rail member, and securing the guide arrangement to a support surface. The method further involves mounting a series of wheel members to each storage unit, with the wheel members being configured to engage the rail members to provide guided movement of the storage unit relative to the support surface. The steps of securing the guide arrangement to the support surface and mounting the wheel members to the storage unit are carried out by selecting either a first orientation in which the wheel members and the rail members provide movement of the storage unit in a first direction, or a second orientation in which the wheel members and the rail member provide movement of the storage unit in a second direction transverse to the first direction.

The invention further contemplates a kit of components for constructing a mobile storage system. The kit of components includes a series of storage unit components that are adapted to be assembled to construct a storage unit, a guide arrangement including at least one rail member which is configured to engage a support surface, and a series of wheel members which are configured to be mounted to the storage unit and to engage the rail member for providing guided movement of the storage unit relative to the support surface. The storage unit components, the guide arrangement and the wheel members are in the form of a set of components that are transported together in a disassembled state to an installation site, and to be assembled at the installation site. The rail member is adapted to be secured to the support surface by either positioning the rail member in an end-to-end relationship relative to rail members of adjacent storage units, to provide lateral movement of the storage units toward and away from each other, or in a spaced apart configuration in which adjacent

rail members are parallel to each other to provide axial movement of the storage units between an extended position and a retracted position.

The present invention further contemplates a method of constructing a mobile storage system including a series of storage units and a rail arrangement, by selecting either a first configuration in which the storage units move laterally toward and away from each other to selectively create a space between adjacent storage units, or a second configuration in which the storage units move axially between a retracted position and an extended position. The method involves selectively configuring the storage units and securing the rail arrangement to the support surface so as to provide either the first configuration or the second configuration.

The various aspects of the invention can be carried out separately and independently, and each provides an improved feature, construction or installation of a mobile storage system. The aspects of the invention may also be used in various sub-combinations or altogether, to provide the desired set of features or advantages for a mobile storage system.

Various other features, objects and advantages of the invention will be made apparent from the following description taken together with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The drawings illustrate the best mode presently contemplated of carrying out the invention.

In the drawings:

Fig. 1 is an isometric view of storage system in accordance with the present invention, in which the storage units are laterally movable so as to selectively create a space between adjacent storage units;

Fig. 2 is an isometric view of one of the storage units incorporated in the storage system of Fig. 1;

Fig. 3 is an enlarged partial isometric view showing a portion of the lower end of the storage unit of Fig. 2;

Fig. 4 is a partial isometric view showing a lower portion of the storage unit of Fig. 2 and a pair of guide rails for guiding movement of the storage unit;

Fig. 5 is an exploded isometric view of the components of the storage unit of Fig. 2 and its associated guide rails as shown in Fig. 4;

Fig. 6 is a partial isometric view showing corner post members, a splice member and support members incorporated in the storage unit of Fig. 4;

Fig. 7 is a partial sectional view taken along line 7-7 of Fig. 6;

Fig. 8 is an enlarged partial isometric view with reference to line 8-8 of Fig. 5;

Fig. 9 is an enlarged partial isometric view with reference to line 9-9 of Fig. 5;

Fig. 10 is an exploded isometric view showing a rail member as in Fig. 4 and an adhesive strip for mounting the rail member to a support surface;

Fig. 11 is an end elevation view of the rail member, adhesive strip and support surface of Fig. 10;

Fig. 12 is a partial section view with reference to line 12-12 of Fig. 11;

Fig. 13 is a top plan view of the rail member of Fig. 10;

Fig. 14 is a top plan view of a series of rail members placed in an end-to-end relationship for guiding movement of the storage units of Fig. 1;

Fig. 15 is an exploded isometric view showing a splice arrangement for securing adjacent rail members together, as shown in Fig. 14;

Fig. 16 is a view similar to Fig. 15, showing the adjacent rail members secured together;

Fig. 17 is an exploded partial isometric view showing a stop member adapted for engagement with an end area of an endmost one of the rail members as in Fig. 14, for controlling the range of movement of the storage units relative to the rail members;

Fig. 18 is an isometric view showing the stop member and rail member of Fig. 17 assembled together;

Fig. 19 is an isometric view of the stop member and rail member end portion as in Fig. 18, from an opposite angle;

Fig. 20 is an isometric view of the stop member of Figs. 17-19;

Fig. 21 is an elevation view of the stop member of Figs. 17-20;

Fig. 22 is a partial exploded isometric view showing a lower portion of one of the storage units as in Fig. 1, together with wheel members adapted to be secured to the lower corners of the storage unit for engagement with the rail members as in Fig. 14 to provide movement of the storage unit on the rail members;

Fig. 23 is an exploded isometric view showing the components of one of the wheel members of Fig. 22, with reference to line 23-23 of Fig. 22;

Fig. 24 is an isometric view of an assembled one of the wheel members of Fig. 22, with reference to line 24-24 of Fig. 22;

Fig. 25 is a top plan view of a mounting member incorporated in one of the wheel members shown in Figs. 22-24;

Fig. 26 is an elevation view of a bumper member incorporated into the wheel member of Figs. 22-24;

Fig. 27 is a transverse section view through the wheel member of Fig. 24;

Fig. 28 is a partial isometric view illustrating a retainer arrangement incorporated in each storage unit as in Fig. 1 for selectively maintaining the storage unit in a predetermined position along the length of the rail members, and showing the retainer arrangement in a raised, disengaged position;

Fig. 29 is a view simile to Fig. 28, showing the retainer arrangement in a lowered, engaged position;

Fig. 30 is a partial section view taken along line 30-30 of Fig. 29;

Fig. 31 is an exploded isometric view illustrating the components of the retainer arrangement of Figs. 28 and 29;

Fig. 32 is a rear elevation view of a handle member incorporated in the retainer arrangement of Figs. 28 and 29;

Fig. 33 is an end elevation view of the handle member of Fig. 32;

Fig. 34 is a plan view illustrating one of the wheel members as in Fig. 24 and the location of a latch member incorporated in the retainer arrangement of Figs. 28 and 29 relative to the wheel member;

Fig. 35 is a partial elevation view showing the wheel member, rail member and latch member of Fig. 34;

Fig. 36 is an isometric view of a storage system in accordance with the present invention, in which the storage units are axially movable between an extended position and a retracted position;

Fig. 37 is an isometric view of one of the storage units incorporated in the storage system of Fig. 36;

Fig. 38 is an exploded isometric view showing a storage unit as in Figs. 36 and 37, together with the associated guide rails for guiding movement of the storage unit between the extended and retracted positions;

Fig. 39 is an exploded isometric view showing the components of the storage unit and the guide rails of Fig. 38;

Fig. 40 is an exploded isometric view of one of the wheel members illustrated in Fig. 39, with reference to line 40-40 of Fig. 39;

Fig. 41 is a partial isometric view of an outer end guide member adapted to be secured to one of the guide rails as shown in Figs. 38 and 39;

Fig. 42 is an isometric view of the outer end guide member of Fig. 41 from an opposite angle;

Fig. 43 is a top plan view of the outer end guide member of Figs. 41 and 42;

Fig. 44 is an elevation view of an outer end guide member of Figs. 41-43;

Fig. 45 is a partial isometric view showing guide rails for adjacent storage units as in Fig. 36, with a stop member for selectively preventing movement of the storage unit beyond its extended positions;

Fig. 46 is a partial isometric view showing outer end portions of a pair of adjacent guide rails as in Fig. 45, with the stop member extending therebetween;

Fig. 47 is an elevation view of the stop member illustrated in Fig. 46; and

Fig. 48 is a partial section view taken along line 48-48 of Fig. 46.

DETAILED DESCRIPTION OF THE INVENTION

As shown in Fig. 1, a mobile storage system 50 generally includes a series of storage units, representatively illustrated at 52a, 52b and 52c, that are movable on rails, shown at 54. Fig. 1 shows storage system 50 in a first configuration, in which storage units 52a, 52b and 52c are laterally movable toward and away from each other, in the direction of arrow 56, to selectively create an aisle or space A between adjacent storage units so as to provide access to items contained on the storage units.

Fig. 2 representatively illustrates the construction of storage units 52a, 52b and 52c. As shown in Fig. 2, storage unit 52a includes a series of corner members or posts 58, in combination with side support members 60 and end support members 62 that extend between and interconnect corner members 58. Side support members 60 and end support members 62 cooperate to support a series of shelves 64, which are adapted to support articles and items to be stored, in a manner as is known.

Referring to Figs. 2-4, a pair of wheel assemblies 66 are mounted to opposite corners of storage 52a, and a pair of wheel assemblies 68 are mounted to the other opposite corners of storage unit 52a. Wheel assemblies 66 and 68 include wheels that engage rails 54, to provide guided movement of storage unit 52a on rails 54.

Each of storage units 52a, 52b and 52c is manufactured and shipped in knock-down, disassembled kit form, including the components illustrated in Fig. 5. The dissembled components, shown in Fig. 5 are packaged together and are assembled on site where the storage unit is to be installed. In this manner, the storage units such as 52a, 52b and 52c are adapted produced and sold through retail outlets, and to be purchased by individual consumers for residential or other light duty applications.

The kit of disassembled components illustrated in Fig. 5, which are adapted to be assembled together to construct a storage unit such as 52a, 52b or 52c, include corner member sections 72 and 74, which are connected together in end-to-end fashion using splice members 76, to form corner members 58. The components of Fig. 5 further include side support members 60 and end support members 62, as well as shelves 64 and wheel assemblies 66 and 68. The components of Fig. 5 further include a pair of rail members,

shown at 54a, as well as a pair of end stops 78 and a series of splice plates 80. In addition, the kit of dissembled components includes a latch handle 82 and a latch member 84, the assembly and operation of which will later be explained.

As shown in Figs. 6 and 7, corner member 58 of each storage unit, such as 52a, is formed by securing corner member sections 72 and 74 together using splice member 76. In accordance with conventional construction, corner member sections 72 and 74 have a cross section defining a pair of legs orientated perpendicular to each other. Rectangular mounting apertures 86 are formed in the legs of corner member sections 72 and 74 at predetermined increments along the length of each leg. An opening 88 is located adjacent each aperture 86.

Splice member 76 has a cross section that corresponds to the cross section of corner member sections 72 and 74. To construct a corner member 58, corner member sections 72 and 74 are positioned such that the lower end of upper section 72 abuts the upper end of lower section 74. Splice member 76 is then placed over the joint between corner member sections 72 and 74, and is secured in place using conventional threaded fasteners that extend through selected openings 88 adjacent the joint between corner member sections 72 and 74.

Side support members 60 and end support members 62 have a generally channel-shaped construction, wherein each defines an upper flange, a lower flange and a vertical web extending therebetween. The vertical web of each of side and end support members 60, 62, respectively, includes an extension that is engageable with one of corner members 58 via a pair of vertically aligned tabs 90 that are shaped so as to allow the tab 90 to pass through one of apertures 86. Apertures 86 have a downward taper, and each aperture 86 is configured to receive one of tabs 90. Application of a downward force to the support member 60, 62 then results in an interference or wedge fit between the upper area of the tab 90 and the lower edge of the opening 86 through which the tab 90 extends. With this arrangement, the side and end support members 60, 62, respectively, may be secured to a corner member 58 in any desired vertical position, according to the desired elevation of the shelf 64 to be supported by the support members 60, 62. An opening 91 is formed in the end

of each support member 60, 62 between tabs 90. If desired, a fastener may be inserted through opening 91 and the aligned opening 88 in corner member section 72 or 74, to maintain the support member in position.

Shelves 64 are configured to be received within the internal area defined by corner members 58, and to engage the upper surfaces of the upper flanges of side and end support members 60, 62, respectively. The upper pair of shelves 64 each have corners defined by perpendicular edges, as shown in Fig. 8. The lower pair of shelves 64 each include a bevel 92 (Fig. 9) at one corner, to provide clearance for latch member 82 when assembled to a selected one of corner members 58.

It can thus be appreciated that a storage unit, such as 52a, can be constructed from components shipped in disassembled kit form and assembled on site in the location at which the storage unit is being installed. Assembly of the storage unit can be accomplished by following a simple set of directions provided with the kit of components, using a minimal number of tools.

Each of rails 54 is constructed from a series of identically constructed rail members, such as 54a as shown in Figs. 10-13. Each rail member 54a is adapted for engagement with a support surface S such as a floor, and includes a central channel 96 defined by a bottom wall 98 and a pair of sidewalls 100. A top wall 102 extends outwardly from each sidewall 100 and is orientated generally parallel to bottom wall 98. An angled outer wall 104 extends outwardly and downwardly from the outer end of each top wall 102. Each top wall 102 includes a series of spaced apart apertures 106 along its length. Apertures 106 are positioned at equally spaced intervals along the length of rail member 54a, and are located in top walls 102 such that each set of apertures 106 in top walls 102 is aligned. In addition, outer walls 104 include a pair of openings 108 adjacent each end of rail member 54a.

Rail member 54a may be secured to support surface S in any satisfactory manner. In the illustrated embodiment, rail member 54a is secured to support surface S via an adhesive member, in the form of an adhesive strip 110, which is interposed between the underside of channel bottom wall 98 and support surface S. Adhesive strip 110 includes a

carrier 112 and upper and lower adhesive layers 114, 116, respectively, in a manner as is known. Adhesive strip 110 has a length that corresponds to the length of rail member 54a, and may either be shipped separately and applied to bottom wall 98 on site, or may be pre-applied to bottom wall 98 during manufacture.

As shown in Fig. 14, a series of rail members 54a, 54b and 54c may be assembled in end-to-end relationship, to form rails 54. The adjacent rail members are connected together via splice members 118, and an end stop 78 is secured to the end of each end most rail member, such as rail members 54a and 54c.

Referring to Figs. 15 and 16, the adjacent rail members, such as rail members 54a and 54b, are adapted to be placed in alignment with each other and in an end-to-end relationship, so that the ends of rail members 54a, 54b abut each other. Splice members 118 are positioned so as to overlap the end areas of outer walls 104, and include a series of aligned openings 122 that are positioned so as to be in alignment with outer wall openings 108 when rail members 54a, 54b are in aligned, abutting relationship. Fasteners 124, which may be in the form of self-tapping screws, extend through splice member openings 122 and into outer wall openings 108, for securing rail members 54a, 54b together. Splice members 118 and outer walls 104 are configured to secure rail members 54a, 54b together without interfering with the rail member channels 96 or top walls 102 and the top wall apertures 106.

Referring to Figs. 17-21, each end stop 78 includes an upper wall 126 and a pair of outer walls 128, which have an angular relationship similar to that of rail member top walls 102 and 104. End stop upper wall 126 includes a pair of laterally aligned openings 130 configured similarly to rail member openings 106, as well as a central recess 132 within which a depending tab 134 is located. Each outer wall 128 includes a pair of spaced apart openings 136.

End stop 78 is engaged with the rail member end by positioning end stop 78 over the rail member end such that upper wall 126 overlies rail member top walls 102 and outer walls 128 overlie rail member outer walls 104. Tab 134 is configured to extend into channel 96, and end stop 78 is positioned so that openings 130 are aligned with the endmost set of rail member openings 106 and outer wall openings 136 are aligned with outer wall

openings 108 of rail member 54a. Fasteners, such as self-tapping screws 138, extend through openings 136 and into openings 108 for securing end stop 78 to rail 54a.

Figs. 22-25 illustrate the construction of wheel assemblies 66, two of which are mounted to opposite lower corners of each storage unit, such as 52a. Wheel assembly 66 includes a mounting bracket 142, which includes a bottom wall 144 and a pair of generally perpendicular upstanding sidewalls 146, 148 that include respective openings 150, 152. Bottom wall 144 includes a wheel opening 154, and a pair of mounting ears 156 extend upwardly from bottom wall 144 at wheel opening 154. Ears 156 define aligned axial openings 158.

A wheel 160 is adapted to be positioned within wheel opening 154 and rotatably mounted to and between ears 156. Wheel 160 includes an outer annular rim 162 engaged with a bearing assembly 164. A pair of bushings 166 define reduced diameter inner portions that are received within and engaged with the inner race of bearing assembly 164, such that rim 162, bearing assembly 164 and bushings 166 define a wheel subassembly adapted for engagement with mounting bracket 142. Bushings 166 define aligned passages 168, and are configured to be positioned between ears 156 so that passages 168 are in alignment with axial openings 158 defined by ears 156. An axle 170 extends through openings 158 and bushing passages 168, to rotatably mount wheel 160 to mounting bracket 142. Axle 170 includes a head 172 which engages one of ears 156. The opposite end of axle 170 includes a transverse passage 174. Axle 170 has a length sufficient to locate passage 174 outwardly of the opposite ear 156, and a pin 176 extends through axial passage 174 to retain axle 170 and wheel 160 in engagement with ears 156,and thereby with mounting bracket 142. Wheel 160 may be secured to mounting bracket 142 during manufacture, or alternatively may be assembled on site by the end user.

Wheel assembly 66 is mounted to one of a pair of opposite corners defined by the lower end of storage unit 52a by placing wheel assembly 66 such that its sidewalls 146, 148 engage the end area of one of side support members 60 and one of end support members 62 at the lower end of storage unit 52a, as well as the lower end of corner member section 74. A fastener, such as a screw 178, extends through opening 152 in bracket sidewall 148,

and through an aligned one of end support member openings 91 and an aligned one of openings 88 in corner member section 74. A nut 180 is engaged with the threads of screw 178. Similarly, a fastener such as a screw 182 extends through opening 150 in bracket sidewall 146, and through an aligned opening 91 in the end of side support member 60 and in the other leg of corner member section 74, for engagement with a nut 184. Screw 182 extends through a passage in a bumper 186, to mount bumper 186 to mounting bracket sidewall 146. As shown in Fig. 26, bumper 186 includes a passage 188 through which the shank of screw 182 extends, as well as a recess 190 within which the head of screw 182 is received.

Each wheel assembly 68 is constructed similarly to wheel assembly 66, and is mounted to one of the corners of storage unit 52a opposite a wheel assembly 66 in the same manner as described with respect to wheel assembly 66. The mounting bracket of each wheel assembly 68 is constructed similarly to the mounting bracket of wheel assembly 66, which enables the wheel assembly 68 to be mounted to a corner at the same side as one of wheel assemblies 66. The mounting bracket of each wheel assembly 68 is configured such that its associated wheel is oriented perpendicular to the wheel 160 of wheel assembly 66, so that the wheels of wheel assemblies 66, 68 are positioned in alignment with each other when wheel assemblies 66, 68 are mounted to the storage unit.

As shown in Fig. 27, the wheel rim 162 of each wheel 160 is configured to be received within the channel 96 of each track 54, so as to provide guided movement of the storage units along the length of tracks 54.

Figs. 28-33 illustrate a retainer or latch arrangement associated with the each of storage units 52a-52c for selectively maintaining the position of the storage unit on rails 54. The retainer or latch arrangement generally includes latch handle 82, which controls movement of latch rod 84, the lower end of which is selectively engaged within one of the rail openings 106 to selectively prevent movement of the storage unit relative to the rail.

Latch handle 82 includes an inner mounting section 198 and an outer hand grip section 200 including a hand hole 202. Mounting section 198 is movably mounted to one of splice members 76, for movement between a lowered, engaged position as shown in Fig. 28

and a raised, disengaged position as shown in Fig. 29. Referring to Fig. 31, mounting section 198 of latch handle 82 includes a pair of vertically aligned slots 204, which are in alignment with the openings in one of the legs of splice member 76. A pair of shoulder bolts 206 are inserted into openings 204, such that the threaded shank of each shoulder bolt 206 extends through the splice member opening and the aligned corner member opening, for engagement with a nut 208. The shoulder section of each shoulder bolt 206 is positioned within the slot 204, so as to provide the dual function of securing splice member 76 in position and mounting latch handle 82 to splice member 76 for movement between the raised, disengaged position and the lowered engaged position. A latch mounting tab 210 extends from the inner edge of mounting section 198. When latch handle 82 is secured in position on splice member 76, latch mounting tab 210 extends inwardly from the inner surface of the corner member legs to which splice member 76 is mounted.

Latch mounting tab 210 includes an opening 212. Latch rod 84 defines an inverted L-shape, including an upper mounting section 214 that extends laterally relative to the remainder of the length of latch rod 84. Mounting section 214 extends through opening 212 in latch mounting tab 210. The remainder of the length of latch member 84 extends vertically, and is positioned adjacent the inside corner defined by corner member 58. The bevels 92 at the corners of the bottom shelves 64 provide clearance for latch rod 84.

With this construction, latch handle 82 and latch rod 84 are subjected to a gravity bias that tends to place latch handle 82 and latch rod 84 in the lowered, operative position of Fig. 29. When latch handle 82 and latch rod 84 are in this position, the lower end of latch rod 84 extends through one of openings 106 in rail 54, to prevent movement of the storage unit 52 relative to the rail 54. When it is desired to move the storage unit 52, the user grasps hand grip section 200 of latch handle 82, and applies a vertical upward force as shown in Fig. 28 so as to move latch handle 82 and latch rod 84 to the raised, inoperative position in which the lower end of latch rod 84 is disengaged from opening 106 in rail 54. The user maintains latch handle 82 and latch rod 84 in the raised, disengaged position during movement of the storage unit 52. Thereafter, the user releases latch handle 82 so as to allow latch handle 82 and latch rod 84 to be moved to the lowered, engaged position under the

influence of the gravity bias, to allow the lower end of latch rod 84 to be engaged within one of openings 106. This functions to maintain the storage unit 52 in the desired position.

Referring to Figs. 34 and 35, the mounting bracket of each wheel assembly, such as mounting bracket 142' of wheel assembly 68, includes an aperture 216 through which the lower end of latch rod 84 extends. Aperture 216 acts as a guide for the lower end of latch rod 84 during movement of latch rod 84 between the lowered, engaged position as shown in solid lines of Fig. 35, and the raised, disengaged position as shown in phantom in Fig. 35.

Fig. 36 illustrates an alternative configuration for storage system 50, in which the storage units such as 52a, 52b and 52c are configured for axial pull-out movement between an extended position and a retracted position, to provide selective access to the contents of each storage unit. In this configuration, the rail sections of each storage unit are positioned in a spaced apart, parallel relationship corresponding to the spacing between the storage unit wheel assemblies. In addition, the storage unit wheel assemblies are secured to the lower end of each storage unit so as to provide axial movement of the storage unit rather than transverse movement as shown in Fig. 1.

Referring to Figs. 37 and 38, rail sections 54a are secured to support surface S as described previously, using adhesive strips 110. An end stop 78 is secured to the inner end of each rail section 54a, also as described previously. An end guide 220 is secured to the outer end of each rail member 54a. In addition, an outer stop member 222 is engaged with end guides 220 at the outer ends of rail members 54a.

In this configuration, the positions of wheel assemblies 66 and 68 are switched relative to the configuration of wheel assemblies 66 and 68 as shown in Fig. 22. Fig. 40 illustrates the construction of wheel assembly 68 which, as noted previously, is similar to that of wheel assembly 66 with the exception that the wheel 160 is in a position perpendicular to that of wheel of 160 of wheel assembly 66. For clarity, the components of wheel assembly 68 analogous to those of wheel assembly 66 are denoted with primed reference characters.

Figs. 41-44 illustrate the construction of end guide 220 and its interconnection with the end of one of the rail members, such as 54a. End guide 220 includes a pair of top wall sections 224, each of which includes an opening 226. A channel section 228 is located between wall sections 224, and includes a bottom wall 230 and sidewalls 232 that are convergent in an outward-to-inward direction. In addition, end guide 220 includes a pair of angled outer walls 234 that extend outwardly and downwardly from the outer edges of top wall sections 224. Each outer wall 234 includes a pair of openings 236.

End guide 220 is secured to the rail section outer end by positioning top wall sections 224 over the rail section top wall 102. End guide outer walls 234 overlie rail outer walls 104, and end guide openings 236 are positioned in alignment with rail outer wall openings 108. Fasteners, such as screws 238, extend through outer wall openings 236 and end guide 220 and into rail outer wall openings 108, to secure end guide 220 to the outer end of rail member 54a. End guide 220 is configured such that bottom wall 230 of channel 228 rests on support surface S, and the inner end of channel 228 has a configuration matching that of rail channel 96. With this construction, each end guide channel 228 provides a mouth or funnel extending from rail channel 96 at the outer end of the rail member.

Fig. 45 illustrates the positioning of a pair of rail members 54a on support surface S, as well as the manner in which adjacent rail members, such as 54b, are interconnected with support surface S for positioning adjacent storage units.

As shown in Figs. 45-47, outer stop member 222 is in the form of an L-shaped member having a bottom wall 240 and an upstanding stop wall 242. A pair of angled mounting walls 244 extend from the ends of bottom wall 240, and have an angle complementary to that of end guide outer wall 234. Each mounting wall 244 includes a pair of openings having the same spacing as openings 236 in end guide outer walls 234. With this construction, outer stop member 222 is positioned so that the openings in mounting walls 244 are in alignment with openings 236 in end guide outer walls 234, which in turn, are in alignment with rail of outer wall openings 108. Screws 238 then extend through the aligned openings into engagement with rail outer wall openings 108 to secure both outer stop member 222 and end guides 220 in position at the rail outer ends.

As shown in Fig. 48, stop wall 242 of outer stop member 222 has a height sufficient to position the upper end of stop wall 242 above the lower extent of the inner end support member 62 of the storage unit. In this manner, as the storage unit is pulled outwardly to the extended position from the retracted position, the lower end of end support member 62 engages stop wall 242, to maintain the rear wheels in engagement with the rails.

In operation, the user moves the selected one of storage units 52a, 52b and 52c away from the retracted position to the extended position by first disengaging latch member 84 from within end guide opening 226, by application of an upward force to latch handle 82 as described previously. The user then pulls the storage unit outwardly to the extended position, as shown in Fig. 36 with respect to storage unit 52b. During such movement of the storage unit, the front wheels, such as 160, of wheel assemblies 66 and 68 move off the rails 54 and onto support surface S. Outer stop member 222 maintains the rear wheels 160 in engagement with the rails 54, as noted previously. In order to return the storage unit to the retracted position, the user applies an inward force to the storage unit so as to advance the storage unit wheels 160 inwardly. As the forward wheels 160 approach the rails, the wheels 160 come into engagement with bottom wall 230 of end guide channel 228, and sidewalls 232 then direct the wheels 160 into rail channels 96. The user then places the storage unit in the retracted position, and releases latch handle 82 such that the lower end of latch rod 84 is moved into end guide opening 226, to maintain the storage unit in the retracted position.

It can thus be appreciate that all of the components of each storage unit, including the associated rails, wheel assemblies and stop components, are produced and packaged together for shipment and transportation to an installation site, which representatively may be a garage, basement or other storage area of a residence or other relatively light duty environment. The user is able to assemble each storage unit, and to then mount the wheels to the storage unit and to secure the rails to the floor so as to provide the desired storage system configuration, e.g., a lateral high density configuration or a pull-out, high density configuration. When the user selects a lateral configuration as in Fig. 1, the components unique to the pull-out application, namely, end guides 220 and outer stop member 222, are not used and may be kept in the event the user later desires to alter the

storage system configuration. Similarly, when the user selects a pull-out configuration as in Fig. 36, the components unique to the lateral configuration, namely, splice plate 80 and bumpers 186, are not used and may be stored for use in the event the user later decides to change the configuration of the storage system.

While the components, construction and assembly of the storage system of the present invention have been shown in described with respect to a specific embodiment, it is understood that variations and alterations are possible and are contemplated as being within the scope of the present invention. For example, and without limitation, while the storage unit components have been shown and described as being manufactured, sold and shipped together in knock-down form, it is also contemplated that the wheel assemblies and rail members may be sold separately from the storage unit for installation in a retrofit manner. In addition, it is understood that the wheel and rail mobilization system of the present invention may be used in connection with any type of storage unit or the like, and is not limited to a shelf-type storage unit as shown and described. It is also contemplated that the mobilization system of the present invention may be used in connection with a worksurface, work bench or the like. In addition, it is also contemplated that various accessories may be provided for the storage units, such as doors, drawers, worksurfaces, end panels, and back panels (either solid or pegboard), etc. Such accessories may be incorporated in the kit of components, or may be offered separately to enable a user to customize the storage system according to the user's requirements. Further, while the present invention shows a latch mechanism that utilizes holes in the rails to selectively prevent movement of the storage unit relative to the rails, it is understood that numerous other types of latch mechanisms may be employed, e.g., a brake or other member that directly engages the support surface as opposed to the rail, or a latch and rail configuration that uses any other type of mating structure to selectively prevent movement of the storage unit relative to the rail. The illustrated embodiment provides a simple, inexpensive and reliable latch mechanism that has been found to function satisfactorily in the storage system of the present invention. Further, it is understood that the illustrated stop arrangements may take any other form then those shown and described. In addition, while the drawings and description disclose use of two rails in both the lateral and

pull-out configurations, it is also understood that guided movement of the storage units may also be provided by a single rail. In this embodiment, one set of wheels of the storage unit is engaged with and moves on the singe rail, and the other set of wheels is engaged with and moves on the support surface such as the floor.

Various alternatives and embodiments are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter regarded as the invention.